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Environmental Noise Impact and Vehicular Traffic Study for National Highway in Industrial Belt of Allahabad District

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Abstract

Elevated noise exposure brings about various detrimental effects on environment when perceived on a regular and long term basis. Areas like Commercial, Industrial and residential zones have been strategically designed to deal with the adverse impacts of noise on the environment and human health. This pilot scale study deals with the intervention of noise in a span of 10 kms en route National Highway (Allahabad –Mirzapur). The observation points were situated in different zones which were mostly affected by the vehicular noise. The observations were recorded by time weighted average of 8 hours during the peak hours, thrice every week. The inference from the study indicated that the noise levels were much higher than the permissible limits as described by Environmental Protection Standards for the selected locations and mitigation measures for reducing the adverse effects of noise on the surroundings have been suggested.

Keywords: *Environmental impact; Highway monitoring; Noise; Pilot scale study; Vehicular traffic.*

1. INTRODUCTION

Noise is defined as any unwanted or undesirable sound which is made to reach human ears. The industrial and vehicular growth has added to its share in the increase of Noise Pollution. Noise can be categorized into two types such as continuous noise and pulsative noise. High continuous noise may cause damage to hearing mechanism leading to hearing impairment and which is much comparatively much lower than that caused by vehicular noise. The study of traffic Noise and the surroundings has been aimed to measure the levels of sound on the Industrial, Commercial as well as Institutional areas of the city. Traffic and vehicular noise has become a serious threat in recent times because of inadequate urban planning of the city in the past. Homes, schools, offices, hospitals, commercial business centers, and other community buildings were routinely built close to the main roads or highways without buffer zones or adequate sound proofing. The issue has been compounded by increase in traffic volumes (two wheelers, heavy motor vehicles, and other vehicles) far beyond the expectations of our early urban planners. The striking increase in the volume of traffic is actually inversely related to the degradation of the environment. Noise pollution and its environmental impact, acts as a major environmental pollutant that is encountered in daily life and has direct effects on human performance. Highway noise is the addition of total noise reaching at a point by all the moving vehicles on that highway. The areas situated near the highways always subjected to noise pollution due to both passenger and freight vehicles. Due to a constant increase in the number of vehicles on the road in the following years at an alarming rate, the intervention of noise on the surrounding has become a serious issue that must be dealt with immediately.

Sound is propagated in a medium in form of pressure variations. All sound pressure level are expressed in db (db is abbreviated for Decibel) is defined as 20 log (p/p_0), where p is the pressure associated with the measurement and p_0 is the reference pressure (20 micro bar). The three weighted network systems are conventionally adopted. The measurements on A-weighted scale were used as it is much nearer to the human ear; expressed in dbA. This study deals with the analysis of the intervention of noise on the areas located on the side of NH-35 (between Location A-E, on the Allahabad - Mirzapur highway). The area undertaken for the study is an industrial belt, and hence the report also analyses the viability of the crucial planning while placing different types of buildings in an industrial area.

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1.1 Site Selection

Naini is located at 25.3792° N, 81.8771° E, the southern part of the Uttar Pradesh at an elevation of 96 meters (316 ft) and stands at the confluence of the Ganges, and Yamuna rivers. Naini is located on the banks of River Yamuna, opposite Allahabad City with the north, across the Ganges, Jhunsi. The area undertaken for study was a stretch of 10 km long the NH-35(Allahabad- Mirzapur highway),starting from Location A to E. Five different locations were selected along this stretch for the collection of data, namely in their order of occurrence. The selected locations were in an industrial zone even though they belonged to a different category and have different levels of permissible sound, all these buildings and institutes are situated along the NH-35 so the intervention of highway noise is very high in these areas and require critical measures for its containment.

2. METHODOLOGY

The instrument used for the measuring of the noise levels was Sound Level Meter (SLM-1315), which records sound level up to a max of 130 db. Vehicular data was also recorded for more precision. The readings were taken at an interval the max possible noise levels in the area. The readings were taken on every alternate day of the week. A suitable comparison was done by plotting a graph between the recorded sound levels and the standard values for the specific zones(silent, residential, commercial and industrial) and the conclusions were drawn from them. Time weighted average was used for computing the final observations for the day. The formulae used for the computation of data are –

$$L_{eq} = [10 * \log_{10} 1/n * (10^{(L1/10)} + (10^{(L2/10)} + nnn. + (10^{(Ln/10)}))]$$

L =Measured noise exposure at different locations

N = total number of readings

Noise levels for vehicle is obtained and then calculates logarithmically to get the total hourly L_{eq} value and the combined hourly L_{eq} is calculated by logarithmic summation of hourly L_{eq} value of each category

3. VEHICULAR TRAFFIC STUDY

As per *Uttar Pradesh Statistical Handbook 2016*, the vehicles in Allahabad have grown at the rate of 7.41% per annum between 2010-11 and 2014-15, presented in Table 1. A number of private vehicles have increased substantially from 0.98 million to 1.52 million during that period However, the growth rate of commercial vehicles (14.5%) is higher than the growth rate of private vehicles (13.77%).

Traffic congestion accounts for about 76% of the delays while about 16% of the delay is due to bad road condition. Other reasons are mismanagement of traffic at rotary junctions due to enforcement issues (4%) and 4% of the delay is at locations such as underpasses, railway crossings etc. Along the road network length, about 64% of the delays lasted upto 60 seconds, 28 % of the delays lasted between 61–120 seconds while about 8 % lasted more than 120 seconds during peak hours.

Table 1. Growth of Vehicles in Allahabad

S.No	Category Of Vehicle	Number Of Vehicles (In Millions)		Annual Compound Growth Rate (%)
1	Private Vehicles	2010	2011	13.77
2	Commercialvehicles	.06	.09	14.5
3	TOTAL	1.04	1.61	13.70

Table 2. Traffic Volume

S.NO	Location	Total PCU'S	Total Vehicles
1	A (Institutional Area)	22,876	31,753
2	B (Industrial Area)	19,657	23,134
3	C (Commercial Area)	30,452	43,781
4	D (Industrial Area)	17,385	28,291
5	E (Institutional Area)	18,185	30,629

Table 3. Ambient Air Quality Standards in respect of Noise Area

Area Code	Category of Area/Zone	Limits in dB(A) Leq*	
		Day Time	Night Time
A	Industrial Zone	75	70
B	Commercial Zone	65	55
C	Residential Zone	55	45
D	Silence Zone	50	40

Note:-

1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
2. Night time shall mean from 10.00 p.m. to 6.00 a.m.
3. Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority.
4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority. * dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing. A "decibel" is a unit in which noise is measured. "A", in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear. Leq: It is an energy mean of the noise level over a specified period.

4. RESULTS & DISCUSSION

The observations show that the noise levels are 22dBA higher at Location A, under tolerance limit for Location B, 20dBA higher than the permissible limit at Location C, 25dBA higher for Location D and 26dBA higher for Location E, which indicates the immediate need of preventive measures to be taken for the intervention of noise due to vehicular traffic in the working environment.

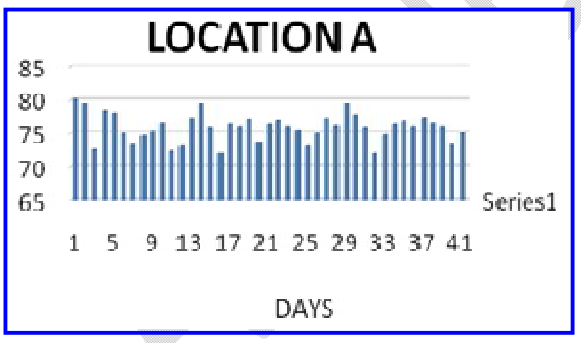

Fig. 1: Institutional Area

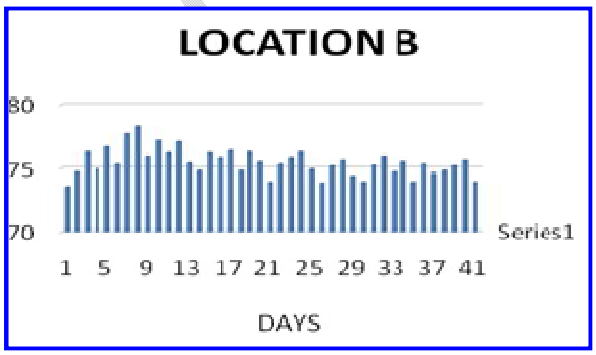

Fig. 2: Industrial Area

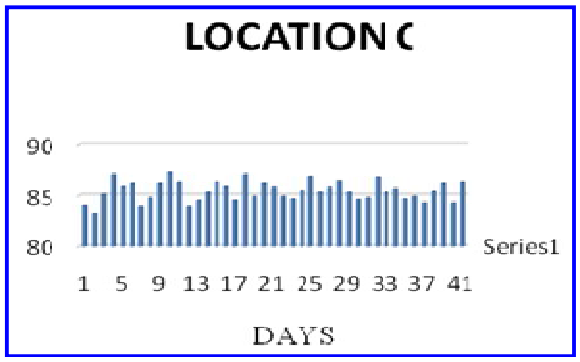

Fig. 3: Commercial Area

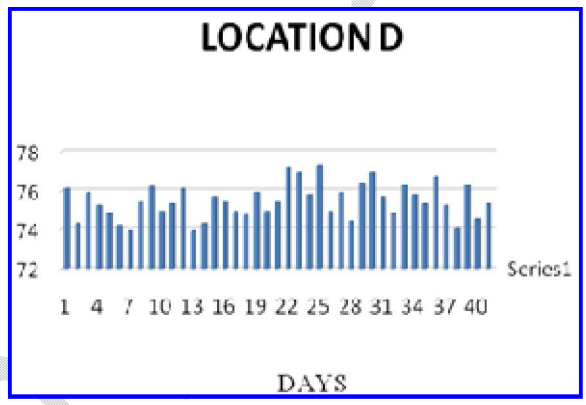

Fig. 4: Industrial Area

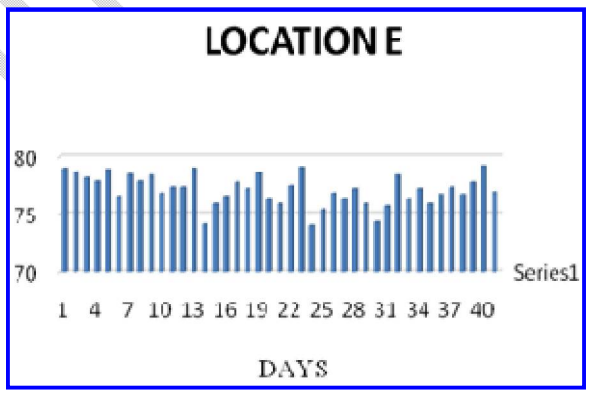

Fig. 5: Institutional Area

The results observed from the charts mentioned above show that the average sound levels on the selected sites is almost way more high than the permissible limits for the designated zones like-

Location A -22 dBA higher than the permissible limits.

Location B - 1.4 dBA higher than the permissible limits but under the tolerance limit.

Location C – 20 dBA higher than the permissible limit.

Location D – 25 dBA higher than the permissible limits.

Location E – 26 dBA higher than the permissible limits.

Except for Location B (Industrial Area) all the other sites are subjected to heavy noise pollution which effects their optimal functioning and affects the proficiency of the production at that site.

5. CONCLUSIONS & RECOMMENDATIONS

Noise levels will increase due to the extra road traffic expected over the next number of years. The work used noise mapping to assess the environmental impact caused by noise in an urban setting of an Industrial Area Naini, Allahabad. The following three stages were evaluated:

(1) Noise levels during peak hours

(2) Noise levels prior to the road restructuring works;

(3) Noise levels immediately after the urban transformation.

The future scenario can be also evaluated based on computational predictions, in which the noise levels generated by the increase in traffic are predicted as a function of changes in land use and occupation of the areas adjacent to the highway. The acoustic mapping is recommended which may aid to reveal the existence of noise pollution in the urban stretch of the highway in all the cases analyzed, when compared with the noise emission limits established for the region by the Central Pollution Control Boards.

The decrease of heavy vehicles afforded by the opening of the Peak hour highway traffic caused a positive environmental impact in mitigating the noise levels. Inversely, however, it served to expand the road network, which resulted in a significantly increased flow of vehicles and a consequent rise in noise levels in the commercial as well as residential areas, resulting in a negative environmental impact.

The noise prediction in future comprises of the elimination of the flow of heavy duty vehicles, leaving only the flow of passenger buses and light vehicles.

Noise mapping by means of computational models will prove to be a very useful tool for calculating and presenting noise levels generated by vehicle traffic, and therefore also a very important tool in environmental management of noise pollution. The mitigation measures for noise management can be summarized as:

(1) Strict control of vehicle noise emissions;

(2) Rigorous control of vehicle speed;

(3) Stimulation of the use of public transportation and of alternatives for urban mobility independent of the use of automobiles; and

(4) Development of permanent environmental noise emission monitoring plans. Another aspect that should be emphasized is the importance of permanent maintenance of the paving conditions of the roads on highways that make up the road network.

Computational models may be correlated in urban planning for noise control in cities. These models facilitate the management and decision-making by government to look for solutions in order to prevent future potential environmental risks.

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